

REMARKS

Claims 18-34 are pending. The Applicants thank Examiner Cole for withdrawing the ground of rejection under 35 U.S.C. 102. The remaining ground of rejection under 35 U.S.C. 103(a) is addressed in detail below.

Liquid Hourly Space Velocity (“LHSV”)

The LHSV is the volumetric flow rate of a liquid based on the volume of the solid catalyst (specification, page 9, lines 5-8). LHSV is a limitation on the process steps and not a characteristic of the product produced.

Rejection – 35 U.S.C. §103

Claims 10-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over Markert et al., DE 19520103 (Abstract). The Applicants traverse this rejection because the present claims are process claims and the cited prior art does not disclose or suggest the process step which requires a LHSV (liquid hourly space volume) of 0.3 to 3.0 hr<sup>-1</sup>. As previously discussed, the LHSV is not an inherent function or property, but a process step.

According to MPEP 2143:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references combined) must teach or suggest all the claim limitations.

Markert does not suggest or provide any motivation for a process which “is carried out continuously under isothermal conditions at a temperature ranging from 45 to 60°C and under a hydrogen pressure of 1 to 300 bar at an LHSV (liquid hourly space velocity) of 0.3 to 3.0 hr<sup>-1</sup>,” as required by Claim 1.

The Official action alleges that it would have been obvious to substitute a continuous process for the batch method of Markert, because this would achieve greater efficiency in the production of butenol and is a frequently employed technique in synthesis chemistry. However, no prior art is cited to support this allegation. While both batch and continuous processes may be known in the prior art, there is simply no suggestion in Markert to substitute a continuous process for a batch process for producing alkyl-substituted butenol.

Second, there is no reasonable expectation of success that substituting a continuous process having the parameters required by Claim 18 would more efficiently produce alkyl-substituted butenols, for example, by preventing reduction of the double bond during the reaction and by providing superior product yields. The claimed process reduces secondary product content, see the specification, page 13, line 29.

Markert et al. disclose a process for the production of alkyl-substituted butenols. Although the basic reactions of Markert et al. are the same as the reactions of the present invention, the temperature condition in the reduction step (ii) is remarkably different between Markert et al. and the present invention. That is, the reduction temperature disclosed by Markert et al. is 160°C in Example (Beispiel) 3 (see page 5, line 14 of Markert et al. and also page 3, lines 1-7 of the specification), while the reduction temperature is “40 to 60°C” in the present invention, see independent Claim 18.

In the reduction step (ii) of the process according to the present invention, only the aldehyde group of the unsaturated aldehyde is reduced while maintaining the double bond intact. If the double bond is also reduced in the reduction step (ii), a saturated product is formed as a by-product. The present invention selects the specific reduction conditions to avoid the reduction of the double bond of the unsaturated aldehyde. One such specific reduction conditions is the specific LHSV now indicated by Claim 18.

In Example 3 (reduction) of Markert et al, 40.0 kg of the crude product of aldol condensation was used per 2.8 kg of the Cu-Zn catalyst, while in Example 3 of the present application, 24.8 kg of the crude product of aldol condensation was used per 26 kg of the Cu/Zn catalyst. The present invention uses a much larger amount of the catalyst in relation to the amount of the crude product than Markert et al.

When the LHSV is set to “0.3 to 3.0 hr<sup>-1</sup>”, the reduction of the unsaturated aldehyde can be carried out at a relatively low temperature of 40 to 60°C and thus the aldehyde group is selectively reduced while the reduction of the double bond is prevented. The process of the present invention is carried out at a relatively low temperature of 45 to 60°C thus preventing over-reactions (or reductions) while the decrease in productivity caused by the low reaction temperature is prevented by carrying out the reaction continuously in a fixed bed reactor. On the other hand, the Markert process is carried out batch-wise (not continuously) at a temperature of 180°C and therefore would not achieve the superior results of the present invention.

The yield of the Markert process was “ca. 81%” (page 5, line 26) of olfactory acceptable products (“geruchlich einwandfreies Product”). However, the yield achieved in Example 3 of the present application was 98% (= 86% of the required valuable product + 12% of a perfumistically attractive accompanying product), which is much higher than the yield in Example 3 of Markert.

Third, the cited prior art, Markert, does not disclose all the elements of the process of Claim 18, namely, a process which “is carried out continuously under isothermal conditions at a temperature ranging from 45 to 60°C and under a hydrogen pressure of 1 to 300 bar at an LHSV (liquid hourly space velocity) of 0.3 to 3.0 hr<sup>-1</sup>”.

The Official Action alleges that all these elements are well-known in the art and that it would have been obvious to optimize the batch process of Markert to be a continuous

process. The standard for reliance on common knowledge in the art or “well known” prior art is discussed by MPEP 2144.03 and the Examiner has relied on “well-known” art to establish that both batch and continuous processes were known in the art.

However, the Official Action also attempts to rely on not cited “well-known” art to establish that continuous processes were known for producing alkyl-substituted butenol and that continuous processes employing the specific reaction conditions, including LHSV, required by Claim 18 were so well known as to “be capable of such instant and unquestionable demonstration as to defy dispute”, see MPEP 2144.03, col. 2 on page 2100-142. Clearly, this is not the case. Therefore, this rejection is based on prior art that does not teach all the elements (process steps) required by the claims and should be withdrawn.

Moreover, in order to impose an obviousness rejection based on an optimization rationale, the Office must show that the variables to be optimized were known to be “results effective”. A results-effective variable is a variable which achieves a recognized result and only results-effective variables can be optimized, MPEP 2144.05 II(B). In the present case, the Office would have had to show that a process which “is carried out continuously under isothermal conditions at a temperature ranging from 45 to 60°C and under a hydrogen pressure of 1 to 300 bar at an LHSV (liquid hourly space velocity) of 0.3 to 3.0 hr<sup>-1</sup>” was known to be a results effective variable. However, the Office has not provided any evidence that this process step was known to be a results-effective variable. Based on the batch process of Markert, one of ordinary skill in the art would not have known whether or not such a step would have achieved any recognized result, much less the higher yields, reduction of undesirable secondary products, or increases in the yields of desired products specifically demonstrated by the inventors.

Accordingly, as there is no suggestion or reasonable expectation of success for the claimed invention, because Markert fails to teach all the elements of the claimed process, and

because there would have been no motivation to optimize variables required by the claimed process that were not known to be results-effective, the Applicants respectfully submit that this rejection should be withdrawn.

CONCLUSION

In view of the above amendments and remarks, the Applicants respectfully submit that this application is now in condition for allowance. Early notification to that effect is respectfully requested.

Respectfully submitted,

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